Attachment A

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of:	)	
Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers	)	CC Docket No. 01-338
Implementation of the Local Competition Provisions in the Telecommunications Act of 1996	)	CC Docket No. 96-98
Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers	)	CC Docket No. 95-185

DECLARATION OF MARK T. BRYANT, Ph.D.
On Behalf of WorldCom, Inc.

Based on my personal knowledge and on information learned in the course of my business duties, I, Mark T. Bryant, declare as follows:

1. My name is Mark T. Bryant. I am employed by WorldCom, Inc., as an Executive Staff Member in the Economic Analysis Group of the Legal and Public Policy organization. In that position, I am responsible for the analysis of economic issues relating to telecommunications industry regulation and public policy, and for assisting in the development and advocacy of WorldCom's public policy positions. For the past eight years, I have had primary responsibility for managing WorldCom's participation in the

development of the HAI Model, an economic-engineering model used in the estimation of telecommunications network costs.

2. The purpose of my declaration is to demonstrate that the economies of scale and scope with respect to loop and transport, including collocation, are so great that no competitive local exchange carrier (CLEC) can at present compete effectively against the incumbent local exchange carriers (ILECs) using either its own facilities or an unbundled loop strategy for anything but large business customers in core urban areas. With the exception of very narrow circumstances, the economies of scale in the transport network not only preclude a CLEC from constructing its own transport, but also preclude a CLEC from using its own switches. However, I will also show that a CLEC could in the future provide service even to residential customers using its own switches if it had access to "concentrated EELs" that allowed it to avoid collocation costs and substantially reduce the cost of transport and if hot cuts became costless and frictionless.

3. I will begin by describing the fixed costs that characterize the telecommunications industry, most of which are also sunk costs. In particular, the fixed costs in constructing the loop plant lead to huge economies of scale that preclude competitors from economically constructing their own loops. Similar economies of scale characterize the transport network. In part, this is because CLECs must collocate at each central office from which they wish to transport traffic and the per customer cost of collocation decreases proportionately with the number of customers.

4. After describing qualitatively the fixed costs in the telecommunications network, I will present a model that demonstrates the impact of those costs quantitatively on a CLEC attempting to compete using its own switches. The model will show that a CLEC

potentially could overcome economies of scale in the switch itself by aggregating traffic from different ILEC central offices on one CLEC switch, but the transport costs involved prevent CLECs from successfully employing such an approach at present. The model further shows, however, that if CLECs had access to EELs and could concentrate traffic over those EELs and obtain seamless loop provisioning from the ILEC, CLECs could then use their own switches to compete effectively against ILECs.

I. ECONOMIC CHARACTERISTICS OF TELECOMMUNICATIONS NETWORKS

5. Economies of scale in the production of any goods or services occur when, as in any industry, fixed costs are present in the overall cost of production. The costs of production may be characterized as either fixed or variable. Fixed costs are those that do not vary with the volume of production, while variable costs are those that vary directly with the volume of production or with the overall size of the business organization. Typically, fixed costs are incurred before the first unit of output can be produced, and do not thereafter vary as the volume of output increases. As such, both the proportion of the unit cost of production attributable to fixed cost as well as the total unit cost decrease as the number of units produced increases. An example of a network component in the local exchange telecommunications network that is characterized by large fixed costs is the cost of supporting structures, such as poles and underground conduit, that must be installed before cables can be connected from local exchange wire centers to distribution areas serving customers' premises. These costs must be incurred before the first customer can be served, and do not increase at all or in direct proportion to the number of customers.

6. While fixed costs generally are those that must be incurred before the first unit of output is produced, certain costs that, strictly speaking, vary with the volume of output, may resemble fixed costs in their effect on total unit production costs. In some cases, the cost of production capacity may be increased smoothly as the volume of production increases. In other cases, the cost of increasing production capacity may be "lumpy" in nature – that is, production capacity may only be increased in relatively large increments. Where this occurs, significant excess capacity may exist for a time until the volume of production rises to efficiently use the increment of capacity added. Because the cost of the additional capacity must be paid whether or not it is used efficiently, the effect on the overall cost structure may be similar to that of startup costs. This effect is most pronounced at relatively low levels of production where the cost of the increment of capacity is relatively large compared to the total cost of production. Local exchange switches, for example, have a fixed capacity in terms of the number of access lines that may be served, and a relatively large fixed cost component – there are significant costs incurred in installing a switch before any lines may be served from the switch. As the number of lines served approaches the line limit of the switch, a second switch must be installed to serve any growth in demand, and a significant increment in fixed cost for the second switch must be incurred. The effect on total cost proportionately is much greater for a local exchange carrier serving relatively fewer customers than for a larger carrier. If a carrier providing service using a single switch must add a second switch, the fixed cost of switching would increase by 100%, while a carrier already using ten switches would experience only a 10% increase in fixed switching costs as a result of installing an additional switch.

7. A natural monopoly generally occurs when economies of scale are very significant, which will occur most often when the fixed cost of production is large compared to the variable cost. In this circumstance, each producer entering the market must incur the greater part of the total cost of providing service to the entire market, regardless of the share of the market served by each producer. Markets with this cost structure will tend inexorably toward supply by a single producer, because the producer with the largest market share will enjoy a cost advantage over all other producers.

8. The telecommunications industry differs from other industries with significant fixed costs, such as the airline industry, in that the network components that contribute to the high fixed costs are permanently set in place before service can commence, and, once placed, cannot be withdrawn and put in service in another location – *i.e.,* the investments are not fungible. If an airline finds that the aircraft that it has purchased to serve a particular route cannot be operated profitably on that route, it may deploy the aircraft on another route, or can sell the aircraft to another company for use in a difference place. The cables, poles and conduits that make up much of the telecommunications network, by contrast, cannot easily be moved, and a large proportion of the investment in these items of equipment is in the labor and use of equipment used to place them in service. In this, the telecommunications industry more closely resembles the distribution portion of the natural gas, water, and electric power industries – all industries that generally are served by a monopoly operator – than the airline, shipping or manufacturing industries, which tend to be more competitive.

9. For most of this century, regulation of the telecommunications industry was premised on the assumption that the operation of local telephone networks was a natural

monopoly. That is to say, experience had shown that due to the economics of constructing telephone networks, as well as the need for interconnection of all subscribers, only one telecommunications network provider could profitably operate in a given local service area. Interconnection can be mandated, thus removing this cause of monopolization. But economies of scale still can remain a major barrier to entry in an industry with large sunk costs.

10. The Telecommunications Act of 1996 (the "Act") may be seen as a market test of the hundred-year-old assumption that the local telecommunications market is a natural monopoly, and of whether, given recent technological advances and changes in the demand for telecommunications services, multiple competitive firms can profitably provide certain components of the market. The Act's requirements that competitors be provided access to unbundled network components clearly contemplates that new entrants may wish to provide certain network elements themselves, and combine these self-provisioned network elements with unbundled network elements obtained from the ILEC. This approach sensibly recognizes that new entrants may not be able to deploy facilities to provide all network elements at once, and that the provision of certain network elements may be subject to constraints on the minimum effective scale at which delivery of each network element is profitable.

A. Loops

11. If any portion of the local network is subject to natural monopoly market conditions, it is the local loop. The loop is that portion of the local exchange network that connects end users with the local exchange switch. It comprises 43% of the total

investment by ILECs in their networks.[1] The loop is characterized by very costly structures, such as poles, conduit and trenches, that support the cable providing end user to wire center connectivity. These structures constitute a very large fixed cost because, in order to serve a particular neighborhood, poles must be placed or trenches must be dug regardless of the number of subscribers in that neighborhood. The effect on unit costs is that cost increases as the number of subscribers decreases, and/or as the distance to reach each subscriber or group of subscribers increases.

12. The loop architecture is a tree-and-branch network. As the cables needed to serve subscribers emerge from the wire center, they typically are very large in size, such that the fixed cost of the supporting structure may be spread over a large number of subscribers. As distance from the wire center increases, the feeder plant branches to serve neighborhoods along the feeder route. As the cable branches, the same supporting structures are required, but carry progressively smaller cables. The fixed cost of the structures, therefore, must be recovered from fewer and fewer subscribers. Finally, the feeder cable terminates in a particular neighborhood. The wire pairs (or fiber optic channels) in the feeder cable are connected to individual wire pairs in the distribution cables. The distribution cables (each requiring the same sort of supporting structures that are required for the feeder cables) then go down streets and alleyways to connect individual households and businesses to the telephone network. Just as in the feeder network, as the distribution cable branches to serve subscriber locations, the same structure is required, but the fixed costs of the structure must be recovered from fewer

[1] Federal Communications Commission, Statistics of Common Carriers, September 15, 2001, Table 2.7. This figure is total cable and wire facilities as a proportion of total telephone plant in service for all reporting carriers.

and fewer subscribers. Thus, large portions of the network have very few subscribers over very large distances (particularly in rural areas), and therefore have relatively very high fixed structure costs.

13. The cost of cables is variable to some extent; larger cables may be placed where large numbers of subscribers are present, and smaller, less costly cables may be placed where fewer subscribers are present. Cables, however, constitute a relatively small component of total investment in cable and wire facilities. In the HAI Model default results for New York Telephone, cable investment is approximately 28% of total loop investment. In addition, cable frequently must be placed in advance of demand. In deciding what size cable to place to serve a given locale, the telephone plant engineer must balance the cost of placing cable that will not initially be used to serve subscribers against the cost of returning to the location at some future time to place additional cables when the cable pairs placed initially are all used to serve subscribers. In areas with high growth rates, the cost of placing and maintaining excess cable may be less than the cost of reinforcing cable at a later date. The need to install excess cable will be particularly acute for a new entrant. Whereas the ILEC need only consider growth in demand due to an increasing population in an area or due to other factors that will stimulate demand for telephone lines for existing subscribers, the new entrant must also consider growth that will occur due to its own marketing efforts, as it attracts subscribers from the incumbent. On a per-subscriber basis, then, the new entrant will face higher "up-front" costs than will the incumbent.

14. The ILEC currently has virtually all subscribers attached to its loop plant, and thus has a relatively large number of subscribers over which the fixed cost of the loop

plant may be spread. It will be difficult, if not impossible, for new entrants profitably to overbuild the existing telephone network, since the new entrant initially would have very few customers from which the same fixed costs may be recovered.

B. Transport

15. At first glance, it might appear that local transport is the network component that is most susceptible to competition. Many cities across the country have multiple competitive access providers (CAPs) in operation, some of which have built extensive urban fiber optic networks. It is important, however, to understand the functions that these CAPs perform and the nature of the connectivity that they provide. For a number of reasons, the services provided by CAPs cannot substitute entirely for the transport network elements that exist in the networks of the ILECs. CAPs provide service almost exclusively over routes with dense concentrations of traffic in core urban areas over short distances. The transport network element must be viewed, at least in the near term, as essential for the provision of competitive local exchange service.

16. Transport facilities are similar in many ways to loop facilities. They both consist of cables supported by poles or buried in trenches or pulled through buried conduit. For both transport facilities and loop facilities, the sources of economies of scale are in the fixed costs of support structures. With transport facilities, just as with loops, structure costs vary directly with distance; the greater the distance to be covered, the more poles or feet of trench or feet of conduit are required. Thus, for any given amount of traffic, the cost per unit of traffic will be lower where large amounts of traffic can be aggregated and carried a short distance than in areas where smaller amounts of traffic must be carried for longer distances.

17. Transport and loop facilities differ in some respects, however, which does somewhat reduce the economies of scale for transport as compared with loops. They differ in the design of the network in which they are deployed, in the bandwidth carried by the cables used in each, and in the sensitivity of each type of facility to the amount of traffic carried. While loop facilities typically are constructed in a tree-and-branch architecture, where large cables near the central office branch into progressively smaller cables as distance from the central office increases, transport facilities typically are constructed as rings, and are of constant bandwidth over their entire length. While cables used in loops are a mixture of fiber optic cables and copper cables, most transport facilities are exclusively constructed using fiber optic cables. Loop facilities generally are engineered with a separate cable pair for each line (newer types of digital subscriber line equipment are capable of concentrating traffic over fewer channels), and are, for the most part, not sensitive to the amount of traffic carried. Transport facilities generally are engineered to have sufficient capacity to meet peak demand loads, and the cost of transport is therefore traffic-sensitive to some degree.

18. Thus, there are substantial economies of scale in transport, although perhaps not as great as with loops. But the ILECs also have additional advantages in providing local service because the CLECs have to transport a higher proportion of thier traffic and have to collocate at all end offices where they serve customers. Within a local exchange area, the ILECs have switches located in each wire center. This provides the ILECs with a number of cost advantages that will not initially be available to new entrants.

19. A large proportion of traffic in the local exchange network originates and terminates within the same central office. This intraoffice traffic need not be transported

by the ILEC. Intraoffice traffic is, for this reason, less costly for the ILEC than interoffice traffic. For the CLEC, which typically does not have switches in ILEC wire centers, all traffic must be transported, even traffic originating and terminating in the same wire center, and thus will be more costly. In constructing its network, therefore, the CLEC must size its transport facilities to carry *all* traffic, while the ILEC need only size its network for that fraction of traffic that is interoffice in nature. This is not an insignificant consideration. According to *Engineering and Operations in the Bell System*,[2] the fraction of total calls that is intraoffice ranges from 31% in urban areas to as much as 66% in rural areas.

20. The ILECs have both interoffice facilities and loop facilities throughout the local exchange area. As a result, at least a portion of the structure costs of interoffice facilities and loop facilities may be shared, thus reducing the unit costs of structure for both loops and transport. This opportunity for cost savings will not initially be available to the CLEC, and may not be available at all depending on whether the CLEC can overbuild the incumbent's loop facilities profitably.

21. A CLEC attempting to provide its own transport in the absence of the availability of concentrated EELs would be required to establish collocation spaces in each ILEC wire center from which it intends to offer service, in order to house the multiplexing and transmission electronics necessary to transmit traffic to or from the ILEC wire center to the CLEC's transport network. While the ILEC too must house multiplexing and transmission electronics in each wire center, it also places one or more switches as well

[2] *Engineering and Operations in the Bell System*, Table 4.5, at 125. AT&T Bell Laboratories, Murray Hill, N.J., 1983.

as loop termination equipment in the wire center. Thus, for the ILEC, the cost of the land and building that make up the wire center may be shared across a wide variety of functions. This same synergy is not available to the CLEC, and the CLEC's transport function must bear the entire cost of the collocation space.

22. As a result of the severe disadvantages faced by new entrants, it is not surprising that competitive provision of transport is severely limited. CAPs entered the market in response to the Commission's expanded interconnection policy. Initially, CAPs competed primarily for the provision of "entrance facilities." That is, they provided high-bandwidth connectivity between interexchange carrier ("IXC") points of presence and ILEC serving wire centers. As such, the transport facilities operated by CAPs did not constitute a network in the sense of connecting multiple points to and among each other, but rather consisted of point-to-point connections, carrying substantial amounts of traffic from one point over a specific route to another point. Where sufficient traffic can be generated to reduce the fixed cost per unit of traffic to a level comparable to that achieved by the ILEC, then competitive transport facilities may be offered profitably. As CAPs have begun to offer a broader range of services, including local exchange service, their networks have evolved to include more customer locations and, in some instances, to provide connections between customer locations. However, CAPs generally are not in the business of providing transport facilities ubiquitously within an ILEC's local exchange area. Certain competitive carriers, including AT&T and WorldCom, have constructed fiber optic transport facilities in a number of cities, connecting a number of locations within the local exchange either to their long distance switch, or increasingly to their local exchange switch. In all cases, these facilities function to provide connectivity

from individual office buildings to the local or long distance switch and, without exception, are located in central business districts or in other areas with large concentrations of business customers (such as corporate campuses or industrial parks). Again, competitive transport facilities can at this time be provided profitably only where large traffic volumes can be aggregated and delivered from one point to another, and where distances are not great.

C. Switching

23. Local exchange switches do not make use of outside plant, as do loops and transport, but nevertheless are subject to some significant economies of scale. It is very difficult to quantify the relative proportions of fixed and variable costs within the switch because information on the actual price paid by local exchange companies for switches is, in all cases, subject to non-disclosure agreements and is claimed to be proprietary by the switch manufacturers. Based on information gathered by the FCC, the HAI model (and the FCC's Synthesis Model) uses a fixed investment of $486,700, and a variable investment per line of $87.00.

24. These figures demonstrate that fixed costs are the largest portion of the cost of the switch and thus that switching may be subject to some economies of scale.

25. In addition to the cost of the switch itself, several items that support the switch also have costs that do not vary with volume. These include the cost of the building housing the switch, the cost of power and air conditioning, and certain test equipment. The basic cost of software used to operate the switch also does not vary with usage, and this can be a significant and recurring cost over the life of the switch.

26. All of this is not to suggest that CLECs cannot economically install switches in local exchange areas – in fact, WorldCom and other carriers are actively deploying switches in local markets across the country. What this information does suggest is that the number of switches deployed by CLECs in a local exchange is likely to be limited, and that this will have effects on other costs, particularly on the cost of transport, that will be experienced by CLECs. In other words, in order to limit the effects of economies of scale for switches, CLECs must aggregate traffic from several ILEC end offices at a single CLEC switch. This, however, forces CLECs to transport more traffic and thus raises the importance of the economies of scale for transport.

II. RECAP OF PREVIOUS DECLARATION

27. In 1999, I filed a declaration in connection with the Commission's review on remand of its implementation of the unbundling provisions of the Communications Act of 1996.[3] That declaration presented the results of a comparative analysis of the costs of incumbent local exchange carriers and competitive local exchange carriers.

28. To compare costs of CLECs and ILECs for the three major network components, modifications were made to the HAI Model, to permit variation of market share for the carrier serving the local exchange. The modified model estimated the cost of building a network to serve the entire local exchange area, but allowed the proportion of total demand served in the exchange to be varied.

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[3] *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996,* CC Docket No. 96-98, Declaration of Mark T. Bryant, Ph.D., attached to Comments of MCI WorldCom, Inc. (filed May 26, 1999).

29. That analysis concluded that, due to economies of scale in all major network components, significant cost disadvantages existed for the new entrant into the exchange at all levels of market penetration less than fifty percent. I found that the cost disadvantage to the new entrant was most severe for loops, somewhat less for transport, and smaller still for switching.

30. As noted in that declaration, a limitation of the study was that it considered only the cost to a CLEC of completely overbuilding an ILEC network in an entire state. It did not consider the cost to a CLEC of constructing only those facilities that would be required if the CLEC were purchasing unbundled loops from the ILEC and providing its own transport and switching facilities, a more likely entry scenario.

III. MODELING CLEC ENTRY SCENARIOS

31. Currently, there are four modes in which CLECs may enter the market for local telecommunications service: 1) the CLEC may enter the market as a total facilities-based carrier, providing its own local loops, switching, transport and other network functions; 2) the CLEC may purchase unbundled loops from the incumbent carrier, providing its own switching and transport; 3) the CLEC may purchase unbundled loops and transport from the ILEC, providing its own switching; and, 4) the CLEC may enter the market using ILEC-provided unbundled loops, switching and transport (also known as UNE-platform or "UNE-P.")

32. Except in those limited instances where a cable company is offering telephony, it appears that no CLEC has been able to enter the market as a total, facilities-based carrier. However, in providing services to business customers in geographic locations where

there is sufficient density, certain CLECs, including WorldCom, have had some success in entering the market as partial facilities-based carriers (mode 1 above). That is, they have been able to deploy last-mile distribution facilities to a limited number of end user locations, while still relying on ILEC last-mile facilities to reach the great majority of the locations where they offer service. The success of this entry is based, in large part, on the relatively lower cost per-circuit of deploying fiber facilities to buildings where there is very high bandwidth demand. In environments such as downtown business districts and industrial parks, it can be economical to construct fiber-optic rings that extend to a limited number of buildings where there is demand for very high bandwidth connectivity.

33. For small business and residential customers, where demand is spread over a much wider geographic area, entry largely has been limited to the use of UNE-P (mode 4), while successful entry using unbundled loops and CLEC-provided switching and/or transport has been almost non-existent. There are many factors that have discouraged the use of unbundled loops, including the lack of seamless ordering and provisioning systems and, in some cases, rates established by some state commissions for unbundled loops far in excess of TELRIC costs. The purpose of the present analysis is to determine whether, aside from these factors, there are fundamental economic factors that would prevent CLEC entry using unbundled loops and using either transport provided by the CLEC or ILEC-provided transport. Stated another way, the analysis examines whether – assuming that unbundled loops were provided by ILECs to CLECs at TELRIC-based rates, and that provisioning of those unbundled loops did not present operational difficulties, – CLEC entry using unbundled loops, in combination either with CLEC-provided transport or with ILEC-provided unbundled transport at TELRIC rates, can be profitable.

34. My earlier analysis, as described above, was designed simply to illustrate the economies of scale present in the three major network components and assumed that the CLEC would enter as a total facilities-based carrier. As such, that analysis did not discuss the economics of entry using a combination of CLEC-provided network elements and ILEC-provided unbundled network elements. To address the question presented in the previous paragraph, I designed a simple model to determine the cost that would be incurred by a CLEC by entering a single local exchange market using its own switching facilities and using either its own transport facilities or using ILEC-provided unbundled transport, and permitting comparison of ILEC and CLEC costs under a variety of input assumptions. Because the model only considers a single hypothetical exchange, it need not be as complex as a full-scale cost model such as the HAI Model or the FCC's Synthesis Model. In general, however, the methodology of the model I have developed is similar to that used in the HAI Model and, because the FCC's Synthesis Model uses the switching and transport components of the HAI Model, similar to that model as well. CLEC self-provisioning of the loop is not considered in this analysis. As shown in my previous declaration, the loop is subject to such extreme economies of scale that, with current technology, CLEC duplication of ILEC loop facilities is not feasible, except in the limited circumstances described in paragraph 31 above. The model thus assumes that the CLEC will obtain unbundled loops from the ILEC.

35. The present model considers CLEC entry into a single local exchange market comprising ten wire centers of various sizes. The incumbent LEC has switching facilities in each of the ten wire centers, while the CLEC uses a single switch located coincident

with an ILEC wire center.[4] All wire centers are assumed to be 10 miles apart, with the exception of the two largest wire centers, which are assumed to be two miles apart, representing a central business district. This configuration would be typical of a medium-sized city and its nearby suburban areas. The model does not consider more rural serving areas. Because population density is much less in rural areas than in suburban areas, and wire centers consequently are further apart and serve smaller amounts of traffic, costs to serve these areas are much higher, particularly for a carrier serving only a portion of the total demand. The model results, then, could be considered to be a best-case scenario for the CLEC.

36. The model permits calculation of ILEC monthly switching and transport costs per line and CLEC switching and transport costs for two cases: 1) the CLEC collocates at every ILEC end office, builds and operates its own interoffice transport network, and provides its own switching facilities; and 2) the CLEC leases "concentrated EELs" from the ILEC to carry traffic to the CLEC's own switching facility. The CLEC does not collocate at every ILEC end office but only at a single end office where traffic is passed to the CLEC switch. At the other ILEC wire centers, using GR-303 concentration equipment, the local exchange and toll traffic of the CLEC's customers is inserted into unbundled transport facilities purchased from the ILEC at rates set at the ILEC's TELRIC cost of transport for dedicated DS-1 channels. GR-303 equipment permits several loops to be provisioned using a single interoffice DS-0 channel, rather than

[4] Because the model was designed to deal with realistic assumptions regarding potential CLEC market shares, it does not model the case where the CLEC would be required to install a second switch. Using default input assumptions and varying CLEC market penetration, switching results are valid in a range of zero to 25% market share for the CLEC.

requiring the CLEC to purchase a separate interoffice channel for each loop. If GR-303 concentration is not provided in conjunction with the transport, the economic case for CLEC entry would be much worse than that presented here.

37. While the model permits user variation of any of its input assumptions, except for the basic structure of the local exchange network, I have chosen a set of inputs that I believe accurately represent the current cost of equipping and operating a local exchange network. These inputs are described in the remaining paragraphs of this section.

38. Input assumptions used in the model for the price of network components (such as switches, transmission terminal electronics, fiber cable and supporting structures) are those used in the current version of the HAI Model, version 5.2a. These are listed (as are all inputs) in Attachment E.

39. The monthly cost of capital and operating expenses are estimated in the model using factors derived from a run of the HAI Model, using default inputs, for the state of California. Annual minutes of use per line, used in the sizing of interoffice transmission capacity, are derived from the same HAI Model run.

40. The total number of lines in the local exchange modeled is set at 280,000, with the ten wire centers varying in size from 5,000 lines to 70,000 lines. This set of assumptions describes a medium-sized city with a dense central business district and less densely populated suburban areas.

41. Recurring and non-recurring collocation costs are WorldCom estimates based on actual LEC charges in fourteen locations around the country. Non-recurring collocation costs (the cost of setting up the collocation space) are converted to a monthly cost by applying the capital cost factor used in the HAI Model for digital electronic switching.

42. In the HAI Model, the cost of land and buildings for wire centers is assumed to vary with the size of the switch. This assumption is designed to reflect two factors: 1) that a somewhat larger building is required as the switch serves larger numbers of lines; and 2) that large wire centers typically are located in central business districts, where land and building costs are higher. In the present model, this design assumption is implemented for the ILEC, but not for the CLEC. Because the CLEC is likely to locate its wire center in the central business district where most demand is concentrated, the higher land and building cost appropriate to this circumstance is used.

43. The GR-303 equipment used in the case of CLEC purchase of unbundled transport from the ILEC is assumed to achieve a 5:1 concentration ratio of access lines to interoffice transport DS-0 channels. The amount of concentration that actually can be achieved varies according to the nature of traffic originating in each wire center, with wire centers dominated by residential customers typically permitting greater concentration than wire centers dominated by business customers. The 5:1 concentration input assumption is intended to represent an average level of achieved concentration.

44. The model does not consider any costs associated with the local loop, as these are assumed to be purchased by the CLEC from the ILEC at TELRIC-based rates. As a result, the model may overestimate ILEC switching and transport costs because certain economies of scope that exist between the switching and transport functions and the loop function are omitted. Most prominently, 1) certain loop facilities share space in the wire center with switching and transport facilities; and 2) significant sharing of supporting structure costs (poles, trenches and conduits) occurs between transport facilities and loop feeder facilities. Neither of these economies is available to the CLEC, because the CLEC

provides no loop facilities. Consequently the difference between the costs of the ILEC and the CLEC may be understated.

45. The model assumes that total demand in the market is fixed, and that any customers gained by the CLEC are lost by the ILEC. In actuality, competitive entry would be expected to stimulate total demand. Consequently, the model may overestimate both CLEC and ILEC costs. Assuming that each carrier would benefit equally from demand stimulation, however, the relative level of costs for each should not be affected.

46. A significant limitation of the model is that it considers only a single ILEC and a single CLEC operating in the exchange. In actuality, it is possible that more than one CLEC could attempt to enter the market. If this were the case, ILEC costs would remain as predicted by the model for any assumed combined market share for the CLECs, while the cost for each CLEC would be significantly higher than the costs estimated by the model, because each CLEC would have only a portion of the combined CLEC market share. Thus, the model represents a best-case scenario in terms of CLEC costs.

47. This is so for another reason as well. The model does not include the costs or disruption associated with manual hot cuts. At present, these are a substantial barrier to CLEC entry using an unbundled loop strategy.

IV. RESULTS OF STUDY

48. To compare the costs of the CLEC and the ILEC as CLEC market share increases I used the model to compute total per-line costs for the CLEC[5] and the ILEC,

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[5] As indicated in paragraph 2, this study assumes the availability of seamless loop provisioning by the ILECs and, therefore, does not factor in current costs associated with manual hot cuts.

respectively, as CLEC market share is increased from one percent to 15 percent in steps of two percent for each of the two cases described above. The results of the analysis are presented graphically in Attachments A-C to this declaration, and are shown in tabular form in Attachment D.

49. For the first case, where the CLEC builds and operates its own switching and transport facilities, including collocation facilities, the CLEC is at a hopeless cost disadvantage at almost all reasonable levels of market penetration. At three percent penetration, CLEC costs are more than eight times the ILEC cost. At nine percent penetration, the CLEC's costs are over three times the ILEC's costs. At 15% penetration, CLEC costs still are more than twice ILEC costs.

50. For the second case, where the CLEC purchases unbundled transport at TELRIC-based rates from the ILEC, the CLEC also is at a significant cost disadvantage at low levels of market penetration. At three percent market share, the CLEC's costs are almost three times those of the ILEC. As market share for the CLEC increases, however, its costs decline rapidly. At eleven percent market share, CLEC costs are 24% higher than ILEC costs, and at 15% market share CLEC costs are only eight percent higher than ILEC costs.

51. Considering separately the cost of transport, it is clear that the transport component of the network is subject to significant economies of scale. At any level of market penetration, CLEC costs are many times those of the ILEC. Fixed costs in the transport component of the network are present both in the electronics in the wire centers that insert customer traffic into the interoffice outside plant and in the supporting structures for the outside plant. A significant factor contributing to the CLEC cost

disadvantage is the high cost of establishing and maintaining collocation facilities in each ILEC wire center, another fixed cost. In this analysis, these costs are based on the average price paid to the ILECs for such facilities. Lower collocation costs would somewhat improve the cost structure for CLECs.[6]

52. Looking only at the switching network component, it is clear that the ability to aggregate traffic at the switch has a significant impact on unit costs. At three percent market share, CLEC costs are two and one-half times those of the ILEC. As market share increases, CLEC costs decline rapidly, and, in fact become lower than ILEC costs at about thirteen percent market share. Of course, this is so in the model in large part because in the model the CLEC is aggregating the traffic from ten ILEC end offices at a single CLEC switch. The traffic volume at the CLEC's switch is thus not vastly different than that at each ILEC switch.

53. The market share assumptions used in the model should be placed in the perspective of actual CLEC experience in the marketplace. While the model shows CLEC costs approaching ILEC costs at 15% market share where the CLEC provides its own switching and obtains concentrated EELs to transport traffic from ILEC-provided unbundled loops to its switch, this level of market share has been unattainable for most CLECs. WorldCom has been selling local exchange service based on UNE-P in New York since December 1998 and has only achieved seven percent market share to date. WorldCom was able to accomplish this by leveraging its current long distance customer

[6] Moreover, as I indicated earlier, the study presupposes that CLECs can actually obtain in commercial volumes connections to unbundled loops. As a result, my observations on the cost structure of CLECs relate only to transport costs and do not take into account ILEC charges for hot cuts. Hot cut costs would significantly increase the total-firm costs of the CLEC.

base as well as its extensive telemarketing and customer service divisions – resources the average CLEC does not have. Clearly, for a national CLEC, several years would be required to achieve in any market the share necessary to permit it to deploy its own switching facilities for use in conjunction with ILEC-provided unbundled loops and concentrated EELs.

54. CLEC purchase of ILEC unbundled transport permits the CLEC to obtain some of the economies of scale that are present in the ILEC's transport network. It is important to recognize that the CLEC will never be able fully to realize these economies due to the differing nature of the traffic placed on the interoffice network by the CLEC and the ILEC. The ILEC is able to efficiently engineer transport facilities to meet peak demand on the network and thus achieve the lowest possible cost for that network. The CLEC, by contrast, is simply extending the unbundled loops it has purchased from the ILEC from the individual ILEC wire centers to the CLEC's switching facilities. The CLEC, unlike the ILEC, is unable to achieve the same efficiency obtained by the ILEC by precisely matching capacity to demand. While the concentration permitted by GR-303 equipment permits the CLEC to achieve a more efficient utilization of capacity than a 1:1 relationship between loops and interoffice channels, it cannot approach the lower cost that the ILEC can obtain through traffic engineering. If concentrated EELs are not available to the CLEC, the cost disadvantage for the CLEC becomes much worse, as the CLEC would be required to purchase a separate DS-0 transmission channel for each line that it intends to serve.

V. CONCLUSIONS

55. The analysis I have presented illustrates the economies of scale present both in the switching and transport components of the local exchange network. The results presented here are broadly consistent with the results of my 1999 analysis of economies of scale in ranking loop, transport and switching as having progressively lower economies of scale.

56. It is apparent from this analysis that the continued availability of all three major network components on an unbundled basis (the UNE-P option) is essential for successful entry by CLECs into the local exchange market. At any realistic level of market penetration, CLECs will be unable to overcome the economies of scale in either loops or transport, except, perhaps, between very large wire centers and CLEC switching facilities. Consequently, the availability of unbundled loops and transport will continue to be a necessary prerequisite for the development of local exchange competition for the foreseeable future. While the economies of scale present in the switching function can be overcome as CLECs achieve greater levels of market penetration, CLECs are still at an insuperable cost disadvantage at low levels of market penetration, and must continue to rely on ILEC-provided switching to enter the market. As the total amount of traffic aggregated at a central switching location increases, CLECs may be expected to profitably deploy their own switches but only if they can economically transport traffic to the switches. This will require the availability of EELs with concentration. It is important to recognize that this analysis considers only the role of economies of scale in the relative cost structures of CLECs and ILECs. There certainly may be other factors that act as barriers to entry to CLECs, and which must be addressed if competition in the

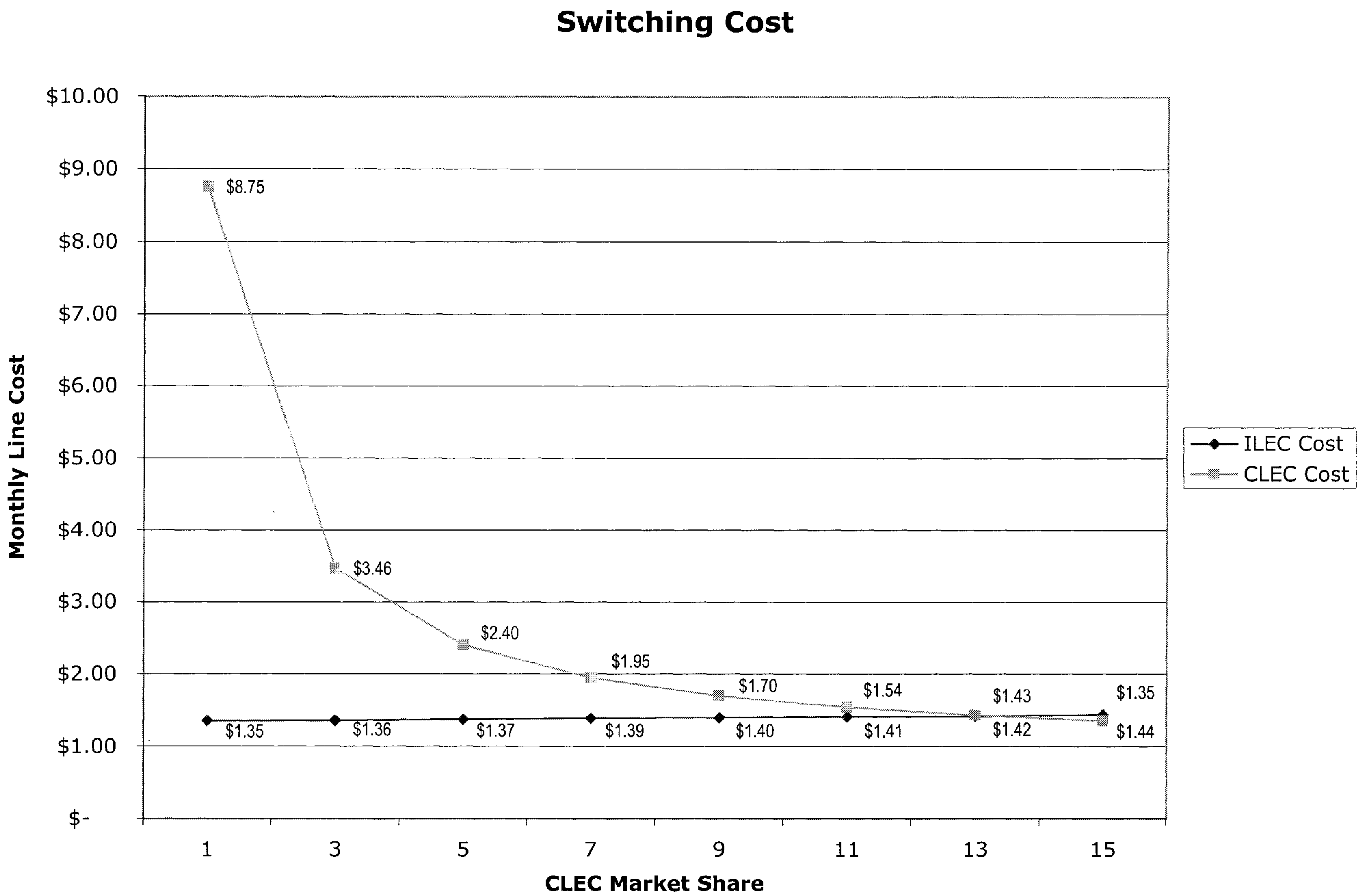
local exchange market is to develop. The cost and difficulty of hot cuts may need to be dramatically reduced, for example, before CLECs can compete profitably using their own switches.

Declaration

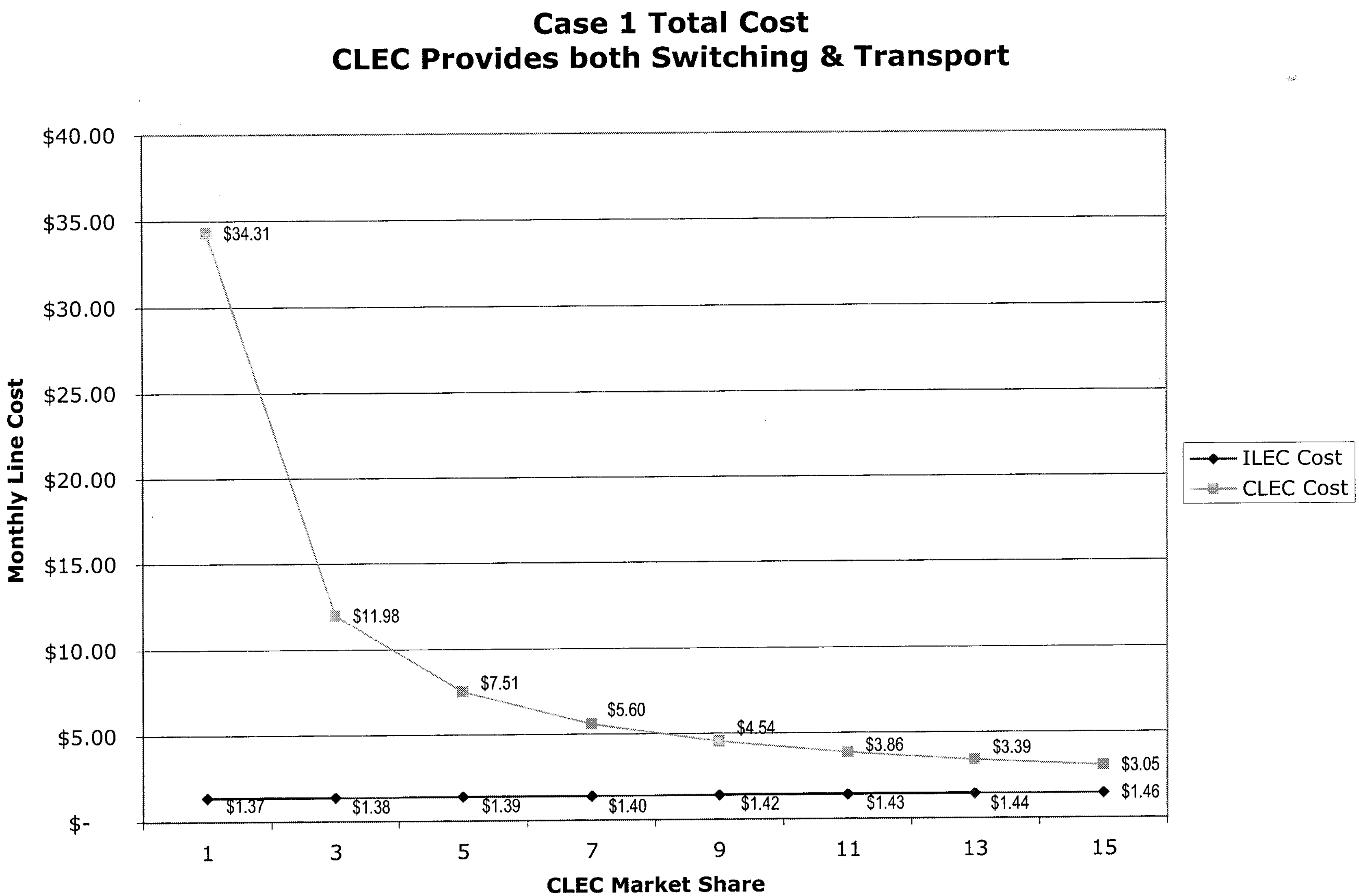
I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 12, 2002.

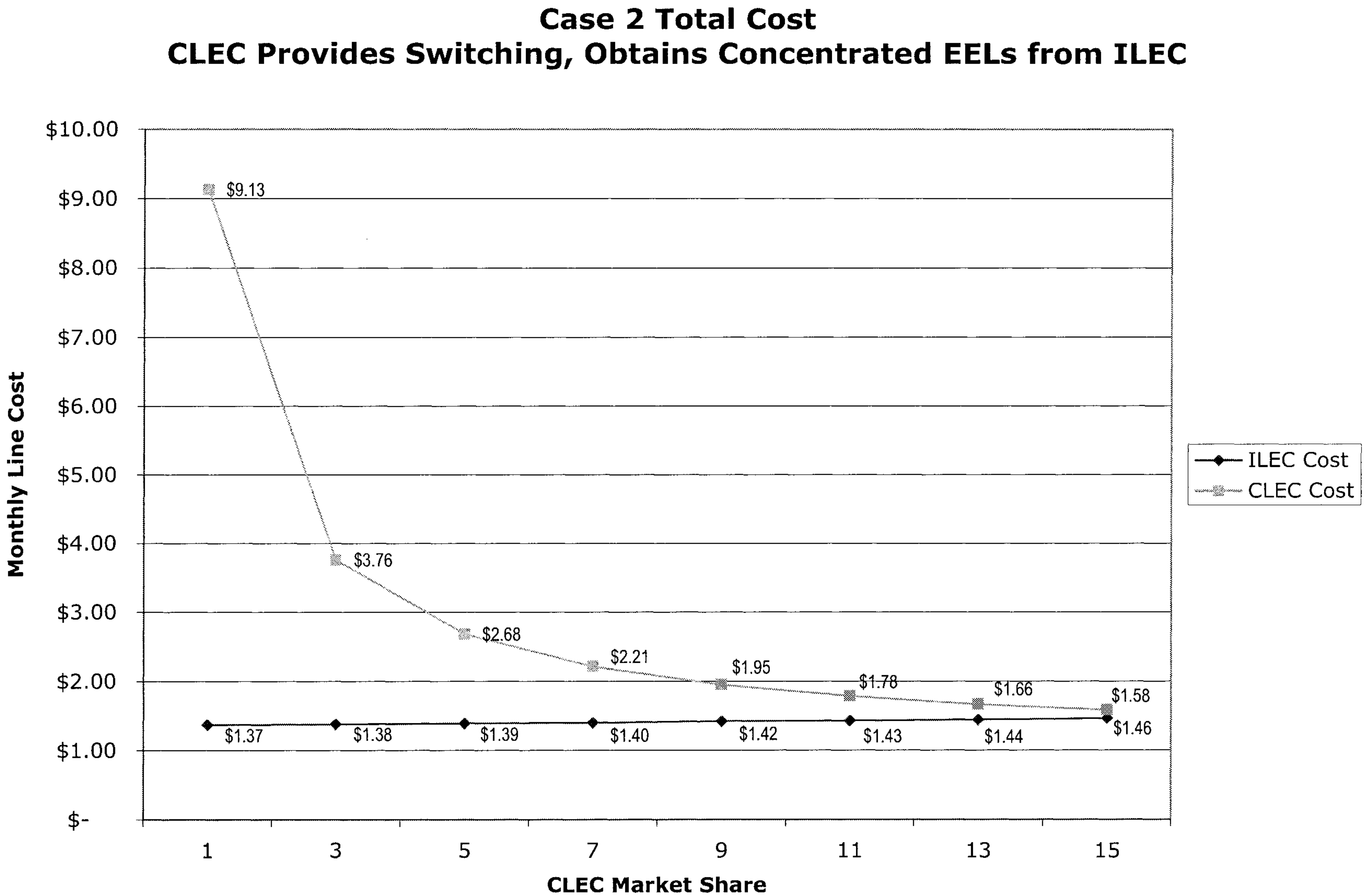
Mark T. Bryant



Bryant Declaration, Attachment A



Bryant Declaration, Attachment B



Bryant Declaration, Attachment C

ILEC and CLEC Costs at Varying CLEC Market Penetration

Switching

CLEC Share	ILEC Cost	CLEC Cost	CLEC/ILEC
1	$ 1.35	$ 8.75	648%
3	$ 1.36	$ 3.46	254%
5	$ 1.37	$ 2.40	175%
7	$ 1.39	$ 1.95	140%
9	$ 1.40	$ 1.70	121%
11	$ 1.41	$ 1.54	109%
13	$ 1.42	$ 1.43	101%
15	$ 1.44	$ 1.35	94%

Case 1 Total

CLEC Share	ILEC Cost	CLEC Cost	CLEC/ILEC
1	$ 1.37	$ 34.31	2504%
3	$ 1.38	$ 11.98	868%
5	$ 1.39	$ 7.51	540%
7	$ 1.40	$ 5.60	400%
9	$ 1.42	$ 4.54	320%
11	$ 1.43	$ 3.86	270%
13	$ 1.44	$ 3.39	235%
15	$ 1.46	$ 3.05	209%

Case 2 Total

CLEC Share	ILEC Cost	CLEC Cost	CLEC/ILEC
1	$ 1.37	$ 9.13	666%
3	$ 1.38	$ 3.76	272%
5	$ 1.39	$ 2.68	193%
7	$ 1.40	$ 2.21	158%
9	$ 1.42	$ 1.95	137%
11	$ 1.43	$ 1.78	124%
13	$ 1.44	$ 1.66	115%
15	$ 1.46	$ 1.58	108%

Model Inputs

CLEC Market Share		5%
EELs concentration ratio		5
Monthly Cost Factor, Switching		0.94%
Monthly Cost Factor, Transport		0.12%
Carrier-to-Carrier customer service factor		0.88%

Switching Inputs

EO amalgamated Switching Fixed Investment, small ICO	$	468,416
EO amalgamated Switching Fixed Investment, RBOC	$	468,416
EO Amalgamated Switching Per Line Investment	$	87
Wirecenter Bldg, 25K Lines	$	625,000
Wirecenter Bldg, 50K Lines	$	1,500,000
Wirecenter Land, 25K Lines	$	150,000
Wirecenter Land, 50K Lines	$	400,000

Collocation Inputs

ILEC Non-recurring charges	$	100,000
Annual Capital Charge Factor, NRCs		14.96%
Collocation Recurring Cost	$	5,500

Transport Inputs

Annual Local DEMs/Line		9,386
Annual Intratstate DEMs/line		2,817
Annual Interstate DEMs/line		1,484
Total DEMs/line		13,687
BH Fraction of Daily Usage		0.10
Annual to Daily Usage Reduction Factor		270.00
Interoffice Distance I-J		2
Interoffice Distance, others		10
Aerial Structure Fraction		20%
Buried Structure Fraction		60%
Underground Structure Fraction		20%
Interoffice Fiber Cable Investment, Installed, per foot	$	3.50

Transport Placement/foot - underground	$	16.40
Transport Placement/foot - buried	$	1.77
Buried Sheath Addition, per foot	$	0.20
Interoffice Conduit	$	0.60
Pullbox Spacing, feet		2000
Pullbox Investment	$	500
Pole Spacing, feet		150
Pole Material and Labor	$	417
Fraction of Interoffice Structure Common with Feeder		75%
Interoffice Structure Sharing Fraction		33%
Total Interoffice Fraction		65%
Maximum Trunk Occupancy, CCS		27.5
Trunk Port Investment, per end	$	100

Port Limit, trunks	100,000
Common Equipment Investment	1,000,000
Maximum Port Fill	0.90
Maximum Real-time Occupancy	0.90

OC-48 ADM, installed, 48 DS-3s	130,372
OC-48 ADM, installed, 12 DS-3s	78,978
OC-3 ADM/Terminal Multiplexer installed, 84 DS-1s	33,764
Investment per 7 DS-1s	1,042
Number of Fibers	24
Pigtrails, per strand	60
Optical Distribution Panel	4,021
DCS installed, per DS-3	8,742
GR-303 Terminal	
High Density DLC Maximum Lines/Increment	672.00
High Density DLC RT Fill Factor	0.90
High Density DLC Basic Common Eqpt Invest + initial lines	66,000.00
High Density DLC POTS Channel Unit Investment	310.00
High Density DLC POTS Lines per CU	4.00
High Density DLC 303/LD crossover, lines	480.00
High Density DLC Common Eqpt Invest per additional 672 lines	18,500.00
High Density DLC Maximum Number of additional line modules/RT	2.00
Low Density DLC Maximum Lines/Increment	120.00
Low Density DLC RT Fill Factor	0.90
Low Density DLC Basic Common Eqpt Invest + initial lines	16,000.00
Low Density DLC POTS Channel Unit Investment	600.00
Low Density DLC POTS Lines per CU	6.00
Low Density DLC Common Eqpt Invest per additional 96 lines	9,400.00
Low Density DLC Maximum Number of additional line modules/RT	1.00